Practical and ethical considerations in the management of pacemaker and implantable cardiac defibrillator devices in terminally ill patients

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More than 4.5 million people worldwide live with an implanted pacemaker, including >3 million in the USA alone. Also, >0.8 million people in the USA have an implantable cardioverter defibrillator (ICD). Knowing the principles of managing these devices towards the end of life is important, as the interruption of their function may have serious consequences. This article provides health care providers who are not specialized in cardiac electrophysiology with an introduction to the general principles of management of pacemakers or ICD devices towards the end of life, with a suggested algorithm for approaching this process. Also discussed are pertinent ethical and practical considerations in deciding on and implementing a management strategy for these devices during terminal illnesses.

The nurse called the on-call cardiology fellow at 1:00 AM asking him to deactivate the cardiac device of a patient pursuing hospice. The patient was a 78-year-old man, admitted with an acute kidney injury on top of chronic kidney disease. The device identification card carried by the patient indicated that he had an implantable cardioverter defibrillator (ICD) for primary prevention after a myocardial infarction. The patient was deemed in need of urgent hemodialysis during this hospitalization, but he was hesitant because of his short life expectancy of 6 to 12 months due to metastatic prostate cancer. The palliative care service was consulted. The patient decided at night, after consulting with his family, that he would rather pursue hospice. Device interrogation showed periods of heart block of varying length, but no fatal arrhythmias. The patient was not interested in any therapies that would prolong his life and requested device deactivation. The patient's daughter stated that she was worried her father was "not thinking straight" and that deactivating the pacemaker device would make him feel bad. What should be done with the device monitoring, defibrillating, and pacing functions? Unfortunately, these case scenarios are not uncommon.

This article is intended to provide health care providers who are not specialized in cardiology or medical ethics with brief insights into the principles and ethical and practical considerations of pacemakers or ICD device management towards the end of life.

GENERAL CONSIDERATIONS

Interruption of cardiovascular implanted electronic device (CIED) function, especially in pacemaker-dependent patients, may have immediate and serious consequences. In 2010, the Heart Rhythm Society, in association with the European Heart Rhythm Association, released an expert consensus statement on the management of CIEDs in patients nearing the end of life or requesting withdrawal of therapy (1). This statement includes an outline of the practical, ethical, legal, and religious principles of managing CIEDs towards the end of life. Basically, patients (or their legally designated surrogates) can request discontinuation of any medical or device treatment. Moreover, it is not necessary for patients to be terminally ill to make these requests.

Several factors affect the strategy to recommend to patients towards the end of life. Having clear answers to these questions eases many of the potential practical, ethical, and legal dilemmas for health care providers. First and foremost, the health care provider should determine if the patient is cognitively competent and able to comprehend the consequences of different changes in device settings. Ideally, discussions about device management in the event of terminal illness should start at the time of implantation. Unfortunately, in real life, only a minority of patients are asked about their wishes at the time of implantation. It is of utmost importance to also discuss this issue when patients with CIEDs are admitted with conditions that could lead to rapid deterioration in their health, especially their cognitive status.

Next, the type of device needs to be identified, as devices may vary considerably in their monitoring/therapy capabilities. Each patient is provided with an identification card, with information about the device and company contact information, at the time of implantation. If the patient does not carry an identification card and the medical records are unavailable, other methods can be used. A chest x-ray provides information about the number and position of the intracardiac leads *(Figure 1)*. A

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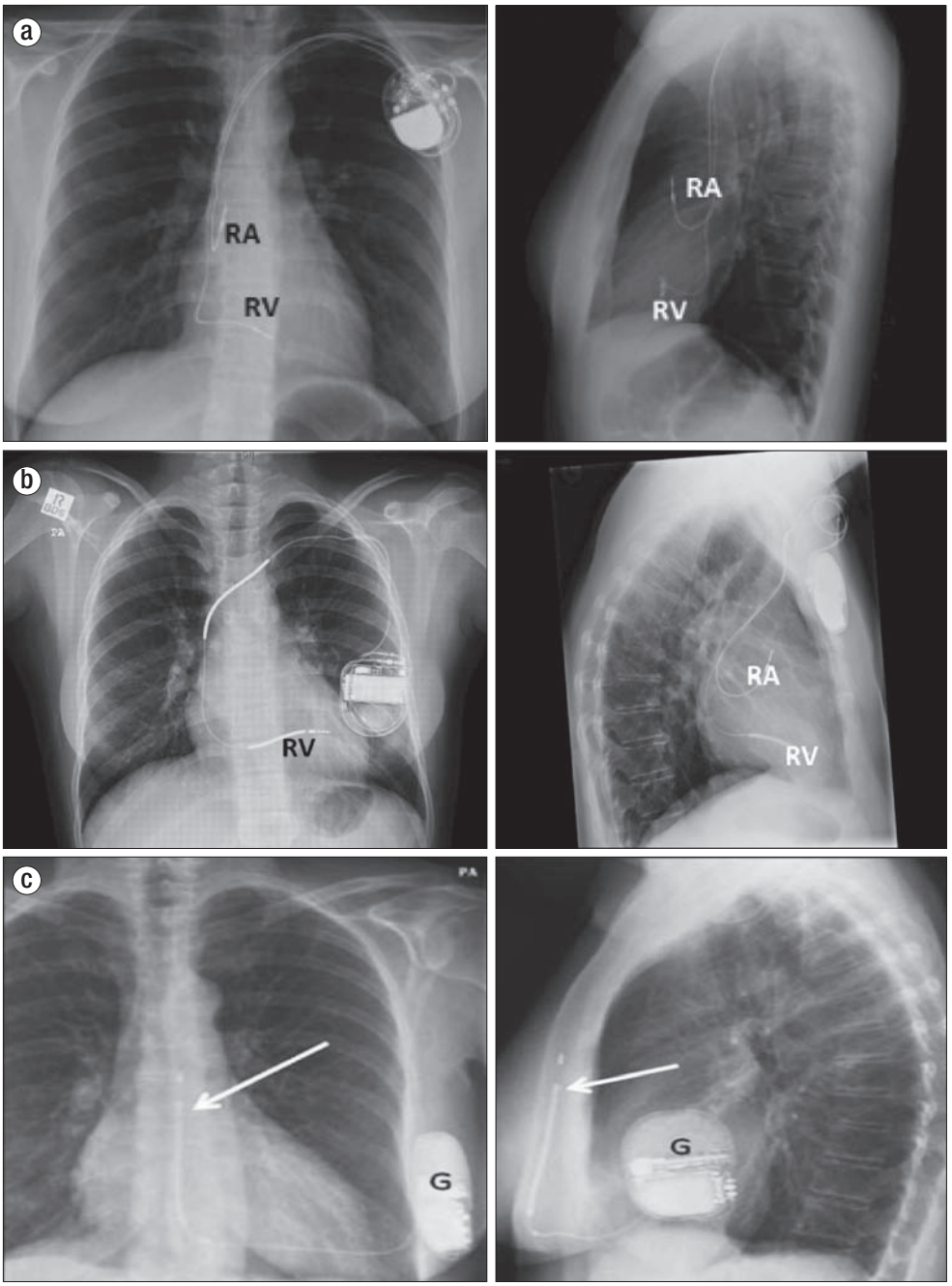

Figure 1. Anteroposterior and lateral views showing the appearance of different device leads on chest x-ray. **(a)** Pacemaker leads in the right atrium (RA) and right ventricle (RV). Some patients have a biventricular device, which would have a similar pacing lead in the coronary sinus. **(b)** A defibrillator lead in the right ventricle (RV). Notice the thickness of the lead due to the defibrillation coil. **(c)** A subcutaneous defibrillator.

thick coil indicates that the device is an ICD. Every ICD lead also has built-in pacemaker functionality, even if pacing was not indicated. Different companies and models have distinct shapes on an x-ray (2, 3). If the device cannot be identified radiologically, different company devices can be applied to identify the device make and model, as a last resort.

The patient's medical condition needs to be studied thoroughly to identify the cardiac condition that led to the device implantation, including a history of any arrhythmias or device therapies or other medical conditions. Often, noncardiac comorbidities are more pertinent to a patient's life expectancy. These comorbidities also help predict potential arrhythmias as the terminal illness progresses. Thus, all pertinent medical records should be obtained and queried for such documentation. Communication between the health care providers themselves, and then between the health care providers and the patient and his or her surrogate(s) or family, is essential to provide information and set expectations. Concise documentation of these communications and detailed consent forms are very important from a legal standpoint (4).

ETHICAL CONSIDERATIONS

Pacemaker-dependent patients may request deactivation of their device towards the end of life. Ethical analyses of withdrawal of CIEDs have compared them to other life-sustaining treatments that physicians readily withdraw near the end of life, such as hemodialysis or mechanical ventilators. Physicians are often concerned that deactivation of pacemaker function towards the end of life could be interpreted as assisted dying, analogous to voluntary euthanasia. Most medical ethicists agree that when death follows withdrawal of treatment, the person's underlying condition is deemed the actual cause of death (4). It is unethical, on the other hand, to "withdraw or discontinue" a treatment that becomes a part of the patient's "self," like a heart transplant. Most ethicists, though, do not consider a pacemaker a part of the patient's self and thus it can be withdrawn, like a ventilator (5). Such withdrawal is lawful, provided that it follows from the person's competent refusal of treatment. Currently in the US, ethically and legally, there are no differences between refusing CIED therapy and requesting withdrawal of CIED therapy. Laws governing the management of CIEDs towards the end of life vary by country, and physicians should acquaint themselves with the rules of their jurisdiction (5–7).

Although patients have the right to request withdrawal of therapy, it is possible that the personal and professional values of the care provider and the patient may differ. Heart Rhythm Society guidelines (1) stipulate that clinicians in this position

have an obligation to arrange for alternative provision of care in cases of conscientious objection that cannot be resolved by ethical or clerical consultation.

It is important to explain to pacemaker-dependent patients that deactivating the pacemaker function might not result in eminent death but rather in inadequate cardiac output symptoms like dizziness and even syncopal episodes.

Disagreements may ensue between family members about the management of a CIED when a patient's decision-making capacity is compromised. Surrogates should usually advocate for the patient's expressed wishes, if known, or otherwise should use their best judgment in determining the patient's most probable choice. Determining early on who has the health care power of attorney and who is the next of kin can help obviate unnecessary friction. Family meetings are necessary to address concerns and misconceptions and often facilitate consensus, but the hospital ethics committee may also need to be involved.

PRACTICAL CONSIDERATIONS

The effect of magnet placement differs by the nature of CIED. Pacemakers respond by switching to an asynchronous pacing mode at a fixed rate depending on the manufacturer, device model, and battery status. If magnet application on a pacemaker site does not produce any response on the pacing rate or mode, the reason might be a depleted pacemaker battery. Alternatively, the device might not be within the magnetic field, as in the case of those with deep (abdominal or submuscular) implants. In almost all pacemakers, removal of the magnet causes the device to revert to pacing at the normal preprogrammed rate. In ICDs, magnet application suspends antitachycardia therapy without any effect on the pacing mode (8).

In patients with a do not resuscitate (DNR) order in force, ICD deactivation should be seriously considered. However, patients with an ICD who have a DNR directive may still benefit from ongoing ICD therapy if the arrhythmias being treated reflect the primary cardiac condition and not an irreversible secondary medical illness or if prompt ICD therapy confers the likelihood of added survival with meaningful quality of life and the patient concurs with this approach.

The deactivation of a CIED does not necessarily mean shutting off its diagnostic capabilities. The patient, or his or her surrogate, needs to decide whether to keep these features on. Some patients might prefer not to know, or not to let their families know, what happens to their heart rhythm. In this case, the consequences of turning off the CIED monitoring features should be explained in detail to the patient, noting that cardiac rhythm data will not be available to guide the treatment of any medical condition.

There is often a misconception among patients and families that a pacemaker will keep the patient alive when he or she would have otherwise died from the underlying disease. Pacemakers are not resuscitative devices, and they will not keep a dying patient alive. Most dying patients become acidotic before cardiac arrest, which effectively renders a pacemaker nonfunctional, as under such conditions, the myocardium does not respond to the pacemaker's discharges. Thus, for most patients, an active pacemaker will not affect the timing or circumstances of death (9).

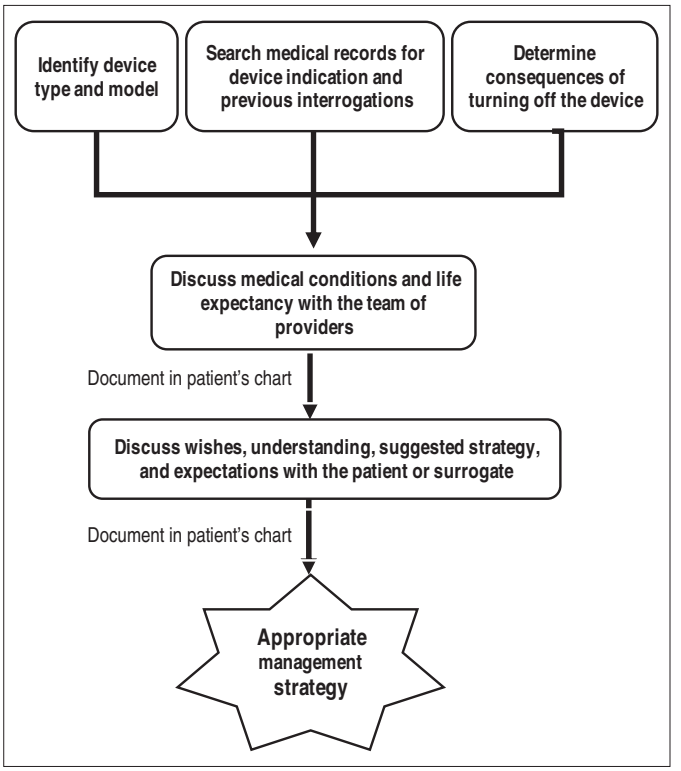

Figure 2. Suggested algorithm for data gathering, decision making, and implementation of changes to device therapy in terminally ill patients.

When a person with an ICD has cardiac arrest from a shockable rhythm, the device delivers a sequence of shocks to terminate the arrhythmia. If the device does not deliver such shocks or if the shockable rhythm persists, external defibrillation should be attempted. External defibrillator electrodes should not be placed close to the CIED site. If a person with a pacemaker or ICD has return of spontaneous circulation after receiving cardiopulmonary resuscitation, the device should be interrogated at the earliest opportunity (10).

In conclusion, the management of CIEDs in terminally ill patients can be complicated; the algorithm in *Figure 2* summarizes appropriate steps for data gathering and decision making in this situation. The concept of patient autonomy underlies both the ethical and legal principles surrounding CIED deactivation, and these principles have been well established. Awareness of the practical and ethical considerations outlined above is essential for the optimal and timely management of CIEDs in terminally ill patients and for optimal communication between health care providers, patients, and their families.

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